NavMed 369

UNITED STATES NAVY

MEDICAL NEWS LETTER

Rear Admiral Bartholomew W. Hogan MC USN - Surgeon General
Captain Leslie B. Marshall MC USN (RET) - Editor

Vol. 32 Friday, 24 October 1958 No. 8

TABLE OF CONTENTS

Postnecrotic Cirrhosis 2
SPECIAL NOTICE 3
Serum Phospholipids 6
Cystic Disease of the Breast 8
Excision of More than Twenty-Five Percent of Body Surface 11
Cardiac Glycosides in Medical Practice 14
Postoperative Myocardial Infarction 15
Cardiac Surgery Associated with Pregnancy 16
Deck Foot 18
Voluntary Retirement 19
Opportunities in Submarine Medicine 19
Submarine Medicine Technic Training - Applicants Desired 20
American Board of Obstetrics and Gynecology 21
MSC Guest Lecture Series 21
Dental Officers Memorial 22
IN MEMORIAM 23
From the Note Book 23
Recent Research Reports 25

DENTAL SECTION

Experiences and Problems with Subperiosteal Implants 28
Dental Corps Exhibit at ADA Meeting in Dallas 29

RESERVE SECTION

Correspondence Course Training 29

AVIATION MEDICINE SECTION

Naval Aviator - Flight Surgeon 32
Pros and Cons of Stimulating Drugs 33
Partial Pressure Suit Protection 37

Postnecrotic Cirrhosis

Characteristically, the lesions of acute viral hepatitis heal without scarring, a fortunate circumstance apparently related to the self-limited character of the infection, the relatively small size of the individual foci of necrosis, and preservation of the supporting reticulum, features which permit rapid regeneration and restoration of the normal lobular architecture.

However, when the zones of necrosis are large and involve whole lobules or groups of contiguous lobules, as is known to occur in the more florid and usually protracted form of viral hepatitis that produces subacute hepatic necrosis (subacute yellow atrophy), there is collapse and ultimate "collagenization" of the supporting stroma and nodular hyperplasia of the surviving parenchyma. This gives rise to a form of cirrhosis in which the liver is studded with coarse nodules separated by broad bands of connective tissue. Occasionally, when the zones of necrosis bridge small groups of lobules in a symmetrical pattern, fine scarring and nodulation result giving the liver a granular appearance. During the early stage of subacute hepatic necrosis, the liver shows the characteristic histological features of acute viral hepatitis, but once extensive scarring and nodulation have occurred, the postnecrotic cirrhosis produced cannot be distinguished from that due to other causes, such as hepatotoxins, drug reactions, and metabolic disorders like the deToni-Fanconi syndrome and Wilson's disease.

On the basis of autopsy experience, it has been estimated that approximately 10% of all cases of cirrhosis seen in this country are of the postnecrotic variety. In only a small fraction of these can the etiology be established with certainty. However, there is an impression, based largely on circumstantial, clinical, and epidemiological evidence, that the hepatitis virus may be responsible for a high proportion of such cases. Certainly, when the cirrhosis follows closely on the heels of a typical attack of acute viral hepatitis with jaundice, there can be little doubt about the etiology. However, in most cases, there is no history of antecedent jaundice so that if the virus is to be implicated, it must be assumed that it is capable of producing subacute hepatic necrosis without jaundice.

This report draws attention to the clinical and morphological features of anicteric infections with the hepatitis virus that give rise to subacute hepatic necrosis and postnecrotic cirrhosis.

The preponderance of middle-aged and elderly women in the group studied was striking; all but one of the 9 patients were women over the age of 40 years.

A relatively abrupt onset with nonspecific constitutional and gastrointestinal symptoms was characteristic. Weakness, fatigability, abdominal pain, anorexia, indigestion, nausea, and vomiting were the principal complaints; they occurred in varied combination and sequence in individual cases.

SPECIAL NOTICE

TO ALL ADDRESSEES (EXCEPT U. S. Navy and Naval Reserve personnel on ACTIVE DUTY and U. S. Navy Ships and Stations).

Existing regulations require that all Bureau and office mailing lists be checked and circularized at least once each year in order to eliminate erroneous and duplicate mailings.

It is, therefore, requested that EACH RECIPIENT of the U. S. Navy Medical News Letter, (EXCEPT U. S. Navy and Naval Reserve personnel on ACTIVE DUTY, and U. S. Navy Ships and Stations) fill in and forward immediately the form appearing below if continuation on the distribution list is desired.

Failure to reply to the address given on the form by 15 December 1958 will automatically cause your name to be removed from the files. Only one (1) answer is necessary. Please state the branch of the Armed Forces (if any) and whether Regular, Reserve, or Retired. Also, please write legibly. If names and addresses cannot be deciphered, it is impossible to compare them with the addressograph plates.

Editor

(Detach here)

Chief, Bureau of Medicine and Surgery _____
Navy Department, Potomac Annex (date)
Washington 25, D. C.

I wish to continue to receive the U. S. Navy Medical News Letter.

Name
or
Activity _____ Ret _____
or (Print or type, last name first) (rank, service, corps)
Civilian Status _____

Address _____
(number) (street)

City _____ Zone ____ State ____

_____
(Signature)

(Please print clearly. Only one answer is necessary.)

Only 2 patients noted fever at the onset. With few exceptions, the abdominal pain was dull aching in character, intermittent, and localized in the epigastrium, and was often aggravated by the ingestion of food or by physical activity. All but 2 patients noted significant weight loss as the disease progressed.

The symptoms were sufficiently troublesome to induce every patient in the group to seek medical attention early in the course of the illness. In no instance was the presence of hepatocellular disease recognized, testifying to the nonspecificity of the complaints. However, it is noteworthy that, despite the absence of clinically detectable jaundice, 5 patients noted dark urine, light stools and/or pruritis, and all 4 patients tested before the appearance of overt signs of liver disease exhibited abnormalities of hepatocellular function—features that were either misinterpreted or dismissed as insignificant.

Careful inquiry revealed only two instances of possible exposure to infection with the hepatitis virus. One patient had been a combat soldier for an extended period in an area in which viral hepatitis was known to be prevalent; another had received a large number of transfusions 30 and 163 days prior to the onset of symptoms.

Frank signs of liver disease first became apparent from 2 to 18 months following the onset of illness. The first sign pointing to involvement of the liver was jaundice in 5 patients, hepatomegaly in 3, and ascites in 1 patient.

Although the onset was anicteric in every instance, jaundice ultimately appeared in 8 of the 9 cases following a preicteric phase which varied in duration from 3 to 55 months. Once jaundice became evident, it tended to persist with only minor fluctuations.

Dark urine was noted by all patients in whom jaundice developed. In addition, there were 6 patients with light stools and 5 with pruritis, features that were responsible for many of the diagnostic errors encountered in this group.

The cases presented clearly indicate that anicteric attacks of hepatitis are capable of producing subacute hepatic necrosis and postnecrotic cirrhosis. The question arises, however, whether the available evidence warrants the assumption that the hepatitis virus was the etiological factor in these cases. Certainly, unequivocal proof—which at present demands transmission of the virus to human volunteers—was not established. However, all the cases fulfilled the less rigid clinical, biochemical, and histological criteria usually considered acceptable evidence of specific infection so that the etiological diagnosis in this group would appear to rest on as firm a basis as it ever does in viral hepatitis, except for the rare instances in which the infection is transmitted to human volunteers. Under some circumstances, epidemiological evidence may lend support to the presumptive diagnosis of viral hepatitis, but in sporadic cases, the frequency with which a history of exposure to infection can be obtained is seldom greater than it was in the present series—namely, in 2 of 9 cases.

Nine cases of subacute hepatic necrosis with progression to post necrotic cirrhosis are described in which the disease appeared to have its inception in an attack of anicteric viral hepatitis. In each instance, biopsy material was obtained sufficiently early in the course of the disease to demonstrate the histological features usually considered diagnostic of the infection.

With one exception, all of the patients were middle-aged or elderly women. Characteristically, the onset was relatively abrupt with nonspecific constitutional and gastrointestinal complaints, but was followed within a period of 2 to 18 months by the appearance of frank signs of chronic liver disease. Jaundice was a late development in 8 of the 9 cases, becoming evident in 3 to 55 months from the onset. Often, it was accompanied by dark urine, light stools, pruritis, and hyperphosphatasemia—features that frequently were misinterpreted as evidence of extrahepatic biliary obstruction. In addition to the hyperphosphatasemia, marked hyperglobulinemia and high levels of thymol turbidity were helpful diagnostic clues. The disease tended to run an intermittently progressive course that was little affected by dietary measures and bedrest, and terminated fatally in 5 of the 9 cases.

Evidence is reviewed to show that females at all ages are peculiarly susceptible to the anicteric form of viral hepatitis that produces subacute hepatic necrosis and postnecrotic cirrhosis. The suggestion is made that such infections which are readily overlooked or misinterpreted may be responsible for many instances of otherwise unexplained cirrhosis—particularly those of the classic postnecrotic variety that occur in females. (Klatskin, G., Subacute Hepatic Necrosis and Postnecrotic Cirrhosis Due to Anicteric Infections with the Hepatitis Virus: Am. J. Med., XXV: 333-357, September 1958)

* * * * * *

Serum Phospholipids

There is increasing evidence that atherosclerosis is a problem with many facets. Extensive investigative work is being conducted on the role of abnormal lipid metabolism as well as carbohydrate and protein metabolism in atherosclerosis. Factors, such as thrombogenesis, blood coagulation, fibrinolysis, arterial wall injury, intimal hemorrhage, and others are also subjects of intensive study.

Most investigators, however, are mainly concerned with the part played by lipids in the genesis of atherosclerosis. At one time, these studies centered around serum cholesterol and cholesterol metabolism. In recent years, the interest in this field has been focused on aspects of lipids and lipoproteins other than cholesterol. For example, it is believed by some that the concentration of triglycerides in the serum may be an important

factor in atherogenesis. Neutral fat transport and metabolism may be important in atherogenesis. The role of the nonesterified fatty acids in lipid transport and their possible relationship to carbohydrate metabolism has been investigated. In the study of dietary factors related to atherogenesis, the effect of saturated versus unsaturated fats is being carefully watched.

In this connection, the role of serum phospholipid deserves consideration. Its presence in atheromatous plaques and its synthesis in the arterial wall are well established. Elevations or depressions of serum cholesterol are usually associated with changes in a similar direction of levels of serum phospholipid.

In contrast to extensive studies on serum cholesterol in relation to age, sex, endocrine factors, and such environmental factors as dietary, climatic, and occupational influences, relatively little information is available concerning corresponding changes of serum phospholipid.

Therefore, it seemed profitable to investigate systematically the levels of serum phospholipid in a normal population sample. The twofold purpose of the study was to establish possible relationships between age, sex, and serum phospholipid level, and to assess the relative importance of genetic versus environmental influences determining serum phospholipid levels in a healthy population.

The sample included 1067 normal persons, 516 males and 551 females aged 2 to 77. Among these, were 156 families consisting of 156 fathers, 156 mothers, and 268 children of these parents. The overwhelming majority of these persons consumed a mixed American diet of the usual protein, carbohydrate, and fat content, similar in its composition to that described by Epstein et al. for the working population in New York City.

Only limited information is available concerning the influence of age, sex, and environmental and hereditary factors on serum phospholipid levels of healthy persons. Almost no information is obtainable on levels in childhood and adolescence or even among adults in significant numbers. Peters and Man concluded that there was no effect of age and sex on serum phospholipid among 108 persons studied. Foldes and Murphy reached the same conclusions. Gertler et al. compared average phospholipid levels of normal control subjects and patients with coronary artery disease. They concluded that the difference between the two groups was significant, but did not evaluate their observation material in regard to age and sex. Epstein et al. could not discern a clear-cut trend in phospholipid levels in relation to age and sex. Lindholm investigated serum lipids in 102 males and 93 females between the ages of 20 and 91. The phospholipid levels increased steadily with age in women, whereas in men this increase was seen only until age 50.

Most investigators have been interested in serum phospholipid levels in disease—particularly atherosclerosis, in the relationship of serum phospholipids to cholesterol and other lipids, in influencing the level under experimental conditions, and in studies of phospholipid synthesis and turnover.

Atheromatous plaques were shown to contain about 20% phospholipid. The present study indicates that serum phospholipid levels of healthy persons consuming a mixed diet increase with age in males earlier in life than in females. They are similar to the age-sex changes previously described for serum cholesterol, but of lesser magnitude. The levels of serum cholesterol and of serum phospholipid are distributed throughout this population as continuous variables. The present data indicate the existence of a genetic factor determining serum phospholipid levels in healthy people.

The positive parent-child and sibling-sibling correlations and the negative mother-father correlations support the concept that serum phospholipid levels are probably genetically determined in the same manner as serum cholesterol levels. These data further indicate that the common environment shared by a family does not lead to common serum phospholipid levels unless blood relationship exists. Thus, such factors as diet cannot be the only factor in determining serum lipid levels of healthy persons.

On the basis of admittedly limited data, the responsible gene or genes are probably not sex-linked. (Schaefer, L. E., Adlersberg, D., Steinberg, A. G., Ph. D., Serum Phospholipids - Genetic and Environmental Influences: Circulation, XVIII: 341-345, September 1958)

* * * * * *

Cystic Disease of the Breast

This report presents the findings in 484 private female patients with cystic disease of the breast, treated from 1933 to 1951, including the clinical histories, operative findings, pathologic reports, therapy administered, and follow-up examinations on 432, or 90%, of the group. This investigation was undertaken, not in an attempt to present solutions to the yet unsolved problems of cystic disease of the breast, but to report various gross and histologic manifestations of the disease observed in this series of patients and to evaluate the results of conservative therapeutic measures utilized in their treatment. Consideration is also given to certain factors which presented themselves that could be of etiologic significance to the disease and its possible relation to malignancy.

It is impossible to determine with any degree of accuracy what percentage of the adult female population is affected with cystic disease of the breast because most women have some pain in the breast occasionally; in the majority of female breasts the lobules are normally firmer than those in surrounding subcutaneous tissue. Also, those patients with microscopic cysts escape detection by routine methods of examination. Because clinical evidence of cystic disease of the breast occurs more frequently than carcinoma, a safe assumption would be that one of every 15 women in the general adult population develops clinical evidence of cystic disease of the mammary gland in a menstrual lifetime.

The highest incidence of cystic disease of the breast was observed between the ages of 40 and 49 years; 45% of the patients were in this range. Fourteen patients, or 3%, were past the age of 70 years, but in all probability, these patients either had cystic disease before menopause or had received estrogenic therapy not recorded in their histories prior to the time a diagnosis of cystic disease was established.

The highest incidence of cancer of the breast in 452 patients with primary carcinoma observed during this period was also between the ages of 40 and 49 years. However, the age distribution in carcinoma was higher past the age of 49 years than that of cystic disease.

Twenty-two percent, or 126 patients, were unmarried with no history of pregnancy; 10%, or 48 patients, were married with no history of pregnancy. Forty-two percent, or 202 patients, had a history of one or more pregnancies. Ninety patients had incomplete histories concerning marital status and pregnancy. In 66 patients in whom adenosis was part of the cystic disease complex, sterility was frequent.

Cystic disease of the breast is a nodular condition, frequently painful, not associated with bacterial inflammation, fat necrosis, or new growth. It frequently presents no symptoms other than a tender lump or thickened area which, when discovered by an intelligent patient, often is accompaned by anxiety. The pain in most cases is not severe except in younger women with adenosis; it may be present only in the premenstrual period and is probably associated with increased vascularity of the breasts produced by an endocrine stimulus resulting in fibrous tissue and epithelial proliferation. Many patients while bathing or dressing accidentally discover a lump or thickened area which is more tender on palpation than the remainder of the breast. A review of the histories of 167 patients in whom cysts were present of sufficient size (4 to 15 cm. in diameter) to be treated by aspiration demonstrated that it was not unusual for the observing patient to note that the lump varied in size from time to time; other patients stated that when a tumor developed rapidly, it was very painful due to an increase in tension of the contained fluid.

Cystic disease of the breast occurs more frequently in younger patients than carcinoma, and in older patients more frequently than fibroadenoma. When a large cyst is present and superficially located, fluctuation can be detected; the tumor is movable in the surrounding breast tissue and retraction is less likely to be present than observed in carcinoma. On the other hand, when there is a deeply located cyst with a thick fibrous wall, it may be difficult to differentiate from carcinoma. Fluctuation does not only indicate the presence of a cyst; occasionally a lipoma, sarcoma, or soft type of carcinoma may produce a soft tender tumor with a smooth surface.

When there is a segment of thickened breast tissue involved, usually small cysts or dilated ducts (1 to 2 cm. in diameter) can be palpated and, as a rule, a correct clinical diagnosis can be established before surgical excision is performed when this treatment is deemed necessary.

Aspiration therapy for discrete cysts of the breast has been used by a number of surgeons with good results; the aspiration should be performed only by surgeons qualified to perform a radical mastectomy when carcinoma is encountered. Since 1933, the author has treated certain patients with discrete cysts of the breast by aspiration of the cyst contents with satisfactory results; however, this method of therapy is not recommended unless the patient agrees to return for follow-up examinations at regular intervals. These patients have cooperated well when this modality of therapy was used. The patient is informed in the beginning that if any of the following conditions develop and persist, the area is to be excised promptly and histologic examination will be made of tissue removed: (1) when aspiration produces a bloody fluid or if the fluid returns immediately following a second aspiration; (2) if the lump in the breast does not completely disappear following aspiration; or (3) if aspiration does not yield fluid.

It has been established by Goldberg and associates that approximately one of every 20 women in the State of New York develops carcinoma of the breast in a lifetime. A careful follow-up of this series of 484 patients with cystic disease for a period of 5 to 18 years disclosed that only 4 developed carcinoma of the breast. Of 452 patients with primary carcinoma of the breast who were treated during the same period, 4 had previously undergone surgery elsewhere for benign lesions of the breast.

Because some authors believe cystic disease of the breast to be a precancerous lesion and recommend simple mastectomy for its treatment, the management of this disease poses two important questions for the clinical surgeon: What advice is he to give patients who consult him with painful nodular breasts, and what source of authority will provide him with an intelligent answer for such patients? When a diagnosis of cystic disease is established, the author assures the patient that there is no more likelihood of carcinoma developing in her breast than in that of any patient of comparable age without cystic disease; and that simple mastectomy is not necessary except in rare cases. Patients in the earlier period of menstrual life with small nodular painful breasts are administered progesterone in oil, 20 mg. twice weekly for 2 weeks before menstruation which gives some symptomatic relief.

Since 1933, the author has used aspiration therapy for discrete cysts of the breast, provided the patient agrees to return at regular intervals for further evaluation. This procedure is more economical for the patient and in only 7 of the 167 patients with discrete lumps treated by aspiration was there a residual mass following dry aspiration. These patients had surgical excision of the tumors which were benign in all 7 cases.

Patients with discrete cysts are advised that if aspiration produces bloody fluid, if the lump does not completely disappear following aspiration, if fluid is not obtained, or in the event that the lump returns after a second aspiration, the involved area of breast will be excised for histologic examination. Regular follow-up examinations of patients in whom aspiration was

performed demonstrated that, in no instance, was carcinoma overlooked. Of 314 patients who had either a discrete cyst or an area of cystic disease localized to one segment of the breast, 311 had surgical excision of the involved area. Three patients had simple mastectomy due to severe mastodynia and to the fact that the involved breasts were riddled with small cysts; in all 3 cases, there was history of breast cancer in several members of the immediate family.

Sixty-seven patients, treated either with aspiration therapy or surgical excision of a discrete cyst or segment of breast affected with cystic disease, developed a second cyst in the same or opposite breast after a period of several months to 16 years. The new cysts were successfully treated by aspiration therapy. (Hendrick, J. W., Results of Treatment of Cystic Disease of the Breast - Five to Eighteen-Year Survey: Surgery, 44: 457-481, September 1958)

* * * * * *

Excision of More than Twenty-Five Percent of Body Surface

Although the survival time of extensively burned patients has increased, modern advances in therapy have not appreciably decreased the mortality rate in this group of patients. If the percentage of area burned for 412 patients treated between 1952 and 1956 is plotted against the percentage of mortality, it is noted that a 55% total body burn is associated with a 50% mortality rate. This experience differs little from the mortality rate reported by Bull and Fisher for 967 cases treated between 1948 and 1952 where a 50% total body burn was associated with a 50% mortality rate.

The influence of infection upon the mortality rate is clearly defined when the causes of 86 deaths occurring between 1950 and 1956 at the U. S. Army Surgical Research Unit are analyzed. Of the 86 deaths, 50 resulted from invasive infection or septicemia. In addition to the 50 deaths resulting from septicemia, 10 proved cases of septicemia survived.

The organisms isolated from this group of patients and their antibiotic sensitivity patterns are shown. Micrococcus pyogenes was recovered in 65% of the cases and found to be sensitive to chloramphenicol (Chloromycetin), bacitracin, erythromycin, and novobiocin (Cathomycin). Pseudomonas and Proteus were recovered in 35% and 20% of the cases, respectively, and were found to be sensitive to polymyxin and chloramphenicol.

Despite all of the 60 patients being treated with this specific antibiotic therapy, only 10 survived. Those patients who died had a mean total body burn of 60% and a mean area of third-degree burn of 40%, as opposed to a mean total body burn of 40%, and a mean area of third-degree burn of 20% in those patients who survived. The mean date of onset of septicemia was

the 11th postburn day, and the mean day of death due to septicemia was the 21st postburn day.

When the interval between burning and the initial positive blood culture is plotted for this group of patients, a precipitous rise in the number of positive blood cultures is noted on the 5th postburn day. If the areas of full-thickness burn harboring these bacteria could be removed prior to this period of invasion and the resulting wound closed with skin grafts, the hazards of septicemia might be circumvented.

In September 1955, an evaluation was planned to test this hypothesis. Cases were selected on the basis of an unexpected mortality rate of 50%. Subjects studied ranged from 5 to 55 years of age. Patients included had a burn index (third degree, also one-half second degree) in the range of 35 to 60, with 25% or more of the body surface involved in full-thickness burn. The patients admitted after the fifth postburn day were treated by conventional methods and those admitted prior to this time were included in the excisional group. All confluent areas of full-thickness burn involving at least 25% of the total body surface were excised. This was done in one or two stages between the 2nd and the 5th postburn days. Autograft and/or homograft coverage was performed immediately, or 48 hours after excision.

The extent of excision was determined by the patient's ability to discriminate sharp pinprick. When possible, adjacent questionable areas of full-thickness burn were included in the area of excision to insure primary wound healing. All areas were excised down to the underlying superficial fascia. Two or more surgical teams were required to keep the operative time under 2 hours for each procedure. During the immediate postexcisional period, a definite clinical improvement was noted in all patients. An interval of 48 hours was usually allowed between the excisional procedure and the application of grafts. All remaining unburned skin was utilized for autografts at the time of the first grafting procedure. Homografts were used to complete the initial skin coverage. The period of protection afforded by the homografts varied from 2 to 4 weeks.

Since September 1955, this study has included 22 patients, 14 patients being treated by early excision and 8 patients being treated by conventional methods. Two of the 8 patients treated by conventional methods survived. Initial grafting in these two patients was started on the 32nd and 24th postburn days, respectively. Autogenous skin coverage was completed on the 90th and 135th postburn days, respectively. The remaining 6 patients developed septicemia between the 7th and 26th postburn day. The mortality rate in the group treated by conventional methods was 75%.

The fourteen patients treated by early excision were divided into three groups. In the first group of five patients, there were two survivors and three deaths. Complete autogenous skin coverage was accomplished in the two survivors on the 30th and 37th days, respectively. The three deaths in this group resulted from septicemia in one patient who died on the 33rd

postburn day; from a pulmonary infarction in one patient who died on the 42nd postburn day; and from an accidental death in one patient who died on the 33rd postburn day.

In the second group of five patients, there were three survivors and two deaths. Complete autogenous skin coverage was accomplished in the three survivors on the 39th, 42nd, and 38th postburn days, respectively. The two deaths in this group resulted from septicemia in one patient on the 10th postburn day and from a Curling's ulcer in one patient on the 37th postburn day.

In the third group of four patients, there were three survivors and one death. Complete autogenous skin coverage was accomplished in these three patients on the 31st, 35th, and 54th postburn days, respectively. The one death in this group resulted from septicemia on the 34th postburn day.

The mortality rate in the excisional group of patients was 42% as compared with a mortality rate of 75% in the group of patients treated by conventional methods. The mean day of complete autogenous skin coverage for the excisional group was the 40th postburn day as compared with the 90th and 135th postburn days for the two patients who survived in the group treated by conventional methods.

While the fourteen cases presented are too small a series from which to draw definite conclusions, certain pertinent observations can be made.

Surgical stress of the magnitude described has been well tolerated and has resulted in no operative deaths. Removal of areas of full-thickness burn involving 25% or more of the total surface has resulted in a temporary improvement in the patient's general clinical condition.

Homografts have been used effectively as a method of temporary wound closure. The shortened period between burning and complete autogenous skin coverage has resulted in a marked decrease in postburn morbidity. The incidence of septicemia has been influenced by early removal of large areas of full-thickness burn.

Experience with this method of treatment gained to date justifies its further critical evaluation. (MacMillan, B.G., Early Excision of More than Twenty-Five Per Cent of Body Surface in the Extensively Burned Patient - An Evaluation: Arch. Surg., 77: 369-374, September 1958)

* * * * * *

Change of Address

Please forward requests for change of address for the News Letter to: Commanding Officer, U.S. Naval Medical School, National Naval Medical Center, Bethesda 14, Md., giving full name, rank, corps, and old and new addresses.

* * * * * *

Cardiac Glycosides in Medical Practice

This article summarizes present knowledge concerning the action of the digitalis glycosides and discusses the choice of the various glycosides in congestive heart-failure.

The primary action of digitalis is on the heart. Its action on the myocardium may be conveniently divided into three components: (1) blocking of atrioventricular conduction, (2) increasing the contractility of the heart muscle, and (3) cardiac slowing, direct and through vagal stimulation.

Digitalis and its preparations are absorbed from the gastrointestinal tract. There is no convincing evidence that the alimentary juices affect the glycosides deleteriously. Absorption usually is complete in 6 to 8 hours. Gold and his associates have shown that the principal glycoside of digitalis, digitoxin, is completely absorbed from the gastrointestinal tract. Destruction by the liver has also been excluded because the oral and intravenous doses of the glycoside are nearly identical. Gitoxin and gitalin are less effectively absorbed.

The fate of the digitalis glycosides in the body is not completely understood. The glycosides accumulate and then undergo a rather uniform rate of degradation for long periods. This has great clinical advantage. Once the heart is digitalized by repeated dosage, with cumulative effect, a so-called maintenance dose may be given. For the average patient, this is 100 to 200 mg. of the powdered leaf. This represents the amount destroyed and excreted daily. The degradation is believed to occur in the liver.

There are numerous cases of digitalis poisoning owing to failure to recognize the danger signals. In most instances, only doses that produce some minor toxic symptoms will achieve the full therapeutic effect of digitalis. The most frequent toxic symptoms are nausea and vomiting; when they persist, the dosage should be reduced. Signs and symptoms of digitalis intoxication do not occur in regular sequence. Headache and nervous irritability may precede or accompany gastrointestinal distress. Greenish-yellow vision and flickering sensations are common. Visual symptoms are a frequent and, almost always, a faithful symptom of intoxication in a patient receiving digitalis. Abdominal pains, parasthesias, tingling of extremities, and facial neuralgia also have been noted.

Cardiac manifestations that may occur are extra ventricular systoles resulting from hyperirritability of the heart. These may pass into ventricular fibrillation and lead to death. Intravenous use of the pure glycosides must be enjoined with great caution owing to the incidence of toxic manifestations.

In choosing a satisfactory digitalis preparation, there are three important considerations: (1) the latent period before action, (2) rate of dissipation, and (3) rate and completeness of absorption. For routine use, the official digitoxin appears to be the drug of choice. The dose for complete digitalization

is about 1.25 mg. Absorption is complete orally and its standardization has been effectively accomplished. Complete effect is achieved in between 6 and 10 hours. For an acutely decompensated patient, this latent period is lengthy and a single intravenous injection of 0.5 mg. of ouabain (strophanthin) is indicated. The effect appears within 10 to 30 minutes; more of the drug may be given, 0.1 mg. at half-hour intervals up to a total of 1 mg. The period of dissipation for ouabain is short; that for digitoxin is long. Ouabain is not available for oral use.

The advantage of a short period of dissipation is obvious if toxic manifestations occur as the rapid degradation and excretion of the drug may soon terminate the toxic effects. With digitoxin, they may persist for long periods due to the drug's prolonged period of action before dissipation. This is an advantage in the routine use of the drug for maintenance therapy. The effect of a single dose of digitoxin may last 8 to 12 days.

Digoxin obtained from Digitalis lanata is rapidly active and has a short dissipation period. It is absorbed by the oral route, but not completely. It has been claimed that medication with Digoxin affords greater freedom from toxic manifestations than does medication with digitoxin. It is doubtful if this claim can be substantiated in the general run of cardiac patients. Work by Batterman and DeGraff in 1947 indicates that digitoxin stands at no disadvantage compared with Digoxin. The average digitalizing dose of Digoxin is from 1 to 2 mg. and the maintenance dose is 0.75 mg.

Amorphous gitalin is gaining prominence as a cardiac glycoside. Like Digoxin, it has a short period of dissipation. Batterman, DeGraff, and Rose found that gitalin exhibited a margin of safety greater than digitalis leaf, digitoxin, or Digoxin. Absorption was dependable in their series of patients. On the average, for therapeutic effect, 100 mg. of digitalis leaf was equivalent to 0.46 mg. of gitalin. On the other hand, for toxic manifestation, 100 mg. of digitalis was equivalent to 0.65 mg of gitalin. Gruhzit and Farah observed that gitalin did not exhibit a greater margin of safety (between the therapeutic and toxic doses) than did the other cardiac glycosides. A Table gives approximate doses of cardiac glycosides for oral and parenteral therapy. (Krantz, J.C. Jr., The Cardiac Glycosides in Medical Practice: Postgrad. Med., 24: 224-230, September 1958)

* * * * * *

Postoperative Myocardial Infarction

Myocardial infarction is not an uncommon postoperative complication; it is particularly prevalent in the older age group. Recent data suggest that myocardial infarction is responsible for 10% of the deaths following major operations in patients above the age of 60 years. The incidence may be even greater because necropsies indicate that the clinical diagnosis of

myocardial infarction as the cause of sudden death is missed in about 50% of the cases. This study presents 3 years' experience at the Graduate Hospital of the University of Pennsylvania with postoperative myocardial infarction and discusses the predisposing and precipitating factors, clinical findings, early diagnosis, and possible methods of prevention and treatment.

Surgery in the older age group and in patients with preexisting cardiovascular disease—particularly with coronary artery involvement—entails an added risk and the danger of coronary thrombosis. The problem of prevention of these complications is of considerable importance.

The mortality of subjects with postoperative myocardial infarction varies within a wide range—from 30 to 66%. In the present series, the mortality was 31.4%.

The prognosis in the individual patient depends on many factors: preexisting degree of coronary artery damage, the extent of the infarcted area, and the presence of complicating visceral diseases. In the older age group, the prognosis in rather extensive infarcts is poor. It is hoped that early diagnosis and appropriate therapy may be of help in decreasing this mortality.

The problem of postoperative myocardial infarction has assumed increasing importance because of the frequency of operative procedures in patients with coronary disease—particularly in the older age group. The authors' experience is recorded relative to the development of postoperative myocardial infarction over a period of 3 years. During this period, 35 patients with this complication were observed in a series of 21,000 operations. Although this complication was observed more frequently during major operative procedures, it is of interest that it was also observed with minor operations. The clinical picture, diagnosis and the differential diagnosis are discussed. The presence of preexisting heart damage particularly involving the coronary arteries in the older age group is an important predisposing factor.

The occurrence of a hypotensive state during operation is an important precipitating factor. The possible prevention and early recognition and treatment of the hypotensive state may be of help in preventing or decreasing the size of the infarcted area. (Feruglio, G., Bellet, S., Stone, H., Postoperative Myocardial Infarction: Arch. Int. Med., 102: 345-352, September 1958)

* * * * * *

Cardiac Surgery Associated with Pregnancy

A report of the experience of the United States Naval Hospital, San Diego, Calif., in the field of cardiac surgery associated with and during pregnancy affords the basis for this article and may be considered as a preliminary report.

The most common lesion of the heart associated with pregnancy is rheumatic mitral stenosis. The aim of mitral commissurotomy is to reduce or remove the obstruction to the blood flow imposed by the diseased valve without creating incompetence or regurgitation. For the patient to be a candidate for surgery in pregnancy, she must have a lesion so incapacitating that its correction is imperative enough to warrant the risk. The valvular lesion must be of a type amenable to operation, and the stenosis must be the cause of enough of the patient's disability that its correction will result in a definite upgrading of her cardiac classification.

The diagnosis of rheumatic mitral stenosis in the pregnant patient does not significantly differ from that in the nonpregnant state. A history of one or more of the components of the rheumatic diathesis is present in about two-thirds of patients. In many instances, the patient has known mitral valvular disease prior to pregnancy and the obstetrician will be asked to follow the patient in close conjunction with the referring internist.

During the 4-year period from 1953 to 1956, inclusive, there have been 39 cardiac operations performed on female patients over the age of 15 years at the U. S. Naval Hospital, San Diego, Calif. Twelve of these patients were nulligravidas and are not included further in the study. There were a total of 62 pregnancies in the remaining 27 patients studied. Prior to operation, there had been a total of 38 full-time deliveries; one of the infants was a Mongoloid and did not survive. There were no therapeutic abortions before operation in any of the 27 cases. There had been 13 abortions, 9 of which were in 1 patient, but none were therapeutically induced. One patient had one delivery followed by a commissurotomy. She subsequently became pregnant and went into severe cardiac failure prior to the third month of gestation, so therapeutic abortion and tubal ligation were performed. Seventy percent of the 27 patients in this report showed marked improvement of the cardiac symptoms after operation and only 2 showed no improvement. Four suffered from embolic phenomena following operation. There were 3 deaths resulting in an operative mortality of 11%.

Eight patients were pregnant at the time of operation. Two had coarctations of the aorta; both of these were delivered of viable term infants without difficulty following surgical repair of the lesion and one has since undergone an uncomplicated pregnancy. Six patients had mitral commissurotomies for stenosis. One died during operation. One was delivered of a premature infant at 31 weeks' gestation (9 weeks following operation). This infant died and was found at autopsy to have had numerous congenital anomalies. One Mongoloid infant was delivered at term. Three patients were delivered of normal term infants subsequent to their operations.

From analysis of the data, the following conclusions seem justified: Certain selected cases of mitral stenosis and most coarctations of the aorta can successfully be surgically repaired with a minimum of morbidity and an acceptable mortality rate in the gravid woman. The operation is best

performed on the pregnant woman prior to the twenty-eighth week of gestation in order to escape the peak load of pregnancy.

Mitral commissurotomy is indicated in all Class III and Class IV pregnant cardiac patients who are being considered for interruption of pregnancy on the basis of failing cardiac reserve, provided the valvular lesion is considered amenable to surgical correction. Pregnancy is not considered a contraindication to operation on the heart or great vessels if performed prior to the twenty-eighth week of gestation.

Cardiac surgery does not appear to affect the fetus adversely or to increase the incidence of prematurity if performed prior to the twenty-eighth week of gestation under the protective influence of progestational hormone therapy.

Therapeutic abortion as a means of terminating a pregnancy on the basis of mitral stenosis is rapidly becoming an obsolete method of management as a result of the successful utilization of mitral commissurotomy in indicated cases and good conservative management in the remainder.

In view of the definite improvement that can be anticipated from a mitral valvulotomy, tubal ligation is no longer indicated in any case requiring therapeutic abortion on the basis of cardiac failure due to mitral heart disease. (LT W. R. Winter MC USN, D. B. Carmicheal, M. D., and I. D. Baronofsky, M. D., CAPT W. S. Baker Jr., MC USN, Cardiac Surgery Associated with Pregnancy: Am. J. Obst. & Gynec., 76:573-585, September 1958)

* * * * * *

Deck Foot

Recent experience at the Naval Hospital, Guantanamo Bay, Cuba, has indicated that an unusual entity is becoming more frequent. This condition has been called "Deck Foot" because it occurs primarily in unconditioned men after being at sea in tropical climates on steel decks. The clinical picture is one of edema, erythema, local heat, petechial hemorrhages, and moderate to severe tenderness without constitutional symptoms. X-Rays are negative for "stress" fractures, and the edema extends from the toes to the mid-tibia at times. The onset occurs from 3 to 14 days after arrival, and recovery after 3 days to 2 weeks of bed rest and elevation of the extremities. It is rare to have a recurrence even though men are returned to full duty at their previous jobs.

The cause of this entity is unknown, but there seems to be no vascular component other than the petechia. It might better be called "stress" edema or cellulitis, as a similar condition is described in poorly conditioned individuals who suddenly have to stand or walk for long periods. (ProfDiv, BuMed)

* * * * * *

Voluntary Retirement

Retirement after 20 or more years of service has been authorized since 1955, and a number of Medical Department officers have been granted this early retirement. It is felt that the availability of early retirement is a distinct addition to the attractiveness of a Navy career.

While general information on voluntary retirement appears to be widely distributed, letters and comments received indicate that some of the details are less widely known. The specific criteria prescribed by the Secretary of the Navy as meriting favorable consideration for early retirement are stated in SecNav Instruction 1811.3A of 10 September 1955, and anyone thinking of making such a request should be fully acquainted with this instruction as well as BuPers Instruction 1811.1A of 19 July 1957.

Among the six criteria listed is that of five years' service in grade for captains as well as 20 years' total service. Other of the listed criteria may be applicable to individual cases. Requests are considered on a basis of the over-all needs of the Service and the merits of the individual case.

Requests should be submitted at least three months and not more than six months ahead of the desired date, and the preretirement physical must be reported to the Chief of Naval Personnel from one to three months in advance. BuPers requires that officers starting a new tour of duty complete at least one year at the new station before voluntary retirement is effected.

Obviously, an unexpected request for retirement creates problems in connection with a relief, and in some instances insufficient time has been allowed in which to arrange for a relief. Consequently, it is most desirable that BuMed be informed of prospective retirement plans as far as possible in advance of the prescribed three months lead time to insure that the desired retirement date can be met.

The Bureau is in no sense urging officers to consider early retirement. This note is simply to urge those who may be thinking of early retirement to become familiar with the requirements and proper procedure as detailed in SecNav and BuPers Instructions. (PersDiv, BuMed)

* * * * * *

Opportunities in Submarine Medicine

Associated with the rapidly expanding underwater activities of the Navy, there is an increasing number of opportunities in submarine medicine. There are some unfilled vacancies in the course for Submarine Medical officers convening in January 1959. Following a 6-months indoctrination which includes practical orientation in submarine and diving operations, underwater physiology, occupational medicine problems of submarines, and short training cruises, a wide variety of duty assignments is available. Some of

these have associated extra pay. Among these are duty with organizations engaged in diving activities, teaching, research, and service with the operational submarine force. Greatest emphasis at this time is placed on training for duty with the nuclear powered submarines. Currently, this is achieved by an academic year spent in the study of radiation biology followed by a period of practical experience at an AEC reactor site. Active plans are under way to provide an alternate condensed period of training in this field which will equip the medical officer adequately for this duty in a period of 6 to 8 months. Much of the Submarine Medicine program of training has been approved for specialty training in one or another field.

Anyone interested in this new and unusual facet of medical science is encouraged to write to: Director, Submarine Medicine Division (Code 75), Bureau of Medicine and Surgery, Washington 25, D. C. for more details.

(SubmarMedDiv, BuMed)

* * * * * *

Submarine Medicine Technic Training - Applicants Desired

As a result of the expanding operational requirements of the Nuclear Powered Submarine Training program, applications for initial training in Submarine Medicine Technic are desired. Applications are particularly needed from highly qualified career minded personnel of the HM rating in pay grades E-5, E-6, and E-7.

In general, eligibility requirements are summarized as follows:

a. Obligated Service - 24 months commencing on convening date of the class..
b. Be a volunteer for sea duty in submarines.
c. GCT & ARI or ARI & MECH of 100. Requests for waivers will be considered on individual merits.
d. Be physically qualified for submarine duty.
e. Age limits are not established.

All commands are requested to give wide publicity to the continuing need for well qualified applicants for training in this specialty.

Applicants should familiarize themselves with the contents of BuPers Instruction 1540.2C for additional information. (ProfDiv, BuMed)

* * * * * *

Use of funds for printing this publication has been approved by the Director of the Bureau of the Budget 19 June 1958.

* * * * * *

American Board of Obstetrics and Gynecology

The Part I Examinations of the American Board of Obstetrics and Gynecology are to be held in various parts of the United States and Canada on Friday, January 16, 1959 at 2:00 p. m.

Candidates notified of their eligibility to participate in Part I must submit their case abstracts within thirty days of notification of eligibility. No candidate may take the Written Examination unless the case abstracts have been received in the office of the Secretary.

Current Bulletins outlining present requirements may be obtained by writing to the Secretary's office.

Office of the Secretary:

Robert L. Faulkner, M. D.
2105 Adelbert Road
Cleveland 6, Ohio

* * * * * *

MSC Guest Lecture Series

The Medical Service Corps Guest Lecture Series for 1958-1959 will be held at the U. S. Naval School of Hospital Administration, National Naval Medical Center, Bethesda, Md. The following lecturers are scheduled:

Date	Speaker	Position
Oct 17, 1958	Kenneth B. Babcock, M. D.	Director, Joint Commission on Accreditation of Hospitals, Chicago, Ill.
Nov 21, 1958	John P. Hagen, Ph. D.	Director, Project Vanguard, U. S. Naval Research Laboratory, Washington, D. C.
Jan 16, 1959	Edwin L. Crosby, M. D.	Director, American Hospital Association, Chicago, Ill.
Feb 20, 1959	George W. Latimer	Associate Judge, U. S. Court of Military Appeals, Washington, D. C.
Mar 20, 1959	James A. Hamilton	Professor and Director, Course in Hospital Administration, Univ. of Minn.

Dental Officers Memorial

Arrangements for a thirty-one chair section to memorialize deceased Dental officers have been completed with officials in charge of the Navy-Marine Corps Memorial Stadium which is well on the way toward completion at the U. S. Naval Academy, Annapolis, Md. Dental officers, both Reserve and Regular, together with business houses associated with dentistry donated a total of $3,117 to finance the Memorial.

Each of the thirty-one chairs will have a small plaque telling the officer's name, rank, and corps plus apropos information, such as decorations awarded and the battlefield or ship on which he fell. The group includes officers killed in battle in World War I and II together with other types of war casualties in World War II and in Korea. One chair will memorialize Vice Admiral Alexander G. Lyle, first Dental Corps Admiral and winner of the Medal of Honor in World War I. Dental Reserve Company 5-5 of Louisville, Ky., and 9-3 of Chicago, Ill., contributed funds to memoralize three deceased Reserve Dental officers who were not war casualties. Another chair memorializing Captain Thomas J. Ownby DC USN was arranged for by his shipmates at the Naval Dental Clinic, Brooklyn, N. Y.

Those who will be honored in the Dental Memorial Section are:

Killed in Action in World War I

LT Weeden E. Osborne DC USN

Killed in Action in World War II

CDR Wadsworth C. Trojakowski DC USN
LCDR Hugh R. Alexander DC USN
LCDR Earl O. Henry DC USNR
LCDR Farrell W. Keith DC USNR
LCDR Laurice A. Tatum DC USNR
LT Edward A. Baumbach DC USNR
LT Thomas P. Capps DC USN
LT James C. Cate DC USNR
LT Thomas E. Crowley DC USN
LT Stanley E. Ekstrom DC USNR
LT Gilbert F. Gorsuch DC USN
LT Charles W. Holly, Jr. DC USN
LT Stephen M. Lehman DC USNR
LT Edward J. O'Reilly DC USN
LT Robert W. Seeger DC USNR
LT Miller C. Wonn DC USNR
LTJG Thomas R. McIntyre DC USNR

Killed or Died as Prisoners of War in World War II

LCDR James A. Connell DC USN
LT Henry C. Knight DC USN
LT Alfred F. White DC USN
LTJG Robert C. Herthneck DC USN

Deceased While Serving Outside United States (Not in Action)

CDR James L. Lea DC USNR
LT Fred M. Stone DC USNR
LT John T. Wieland DC USNR
LTJG Thomas G. Cherikos DC USNR

Deceased Officers Being Honored by Friends

VADM Alexander G. Lyle DC USN
CAPT Thomas J. Ownby DC USN
CDR J. R Bailey DC USNR
CDR J. I. Essig DC USNR
LT John W. Knox DC USN

All hands are heartily thanked and congratulated for their contributions which made the memorial chair section possible. (DentDiv, BuMed)

* * * * * *

IN MEMORIAM

RADM Charles Weite O. Bunker MC USN (Ret)	17 September 1958
RADM Cornelius H. Mack DC USN (Ret)	22 August 1958
CAPT George S. DeShazo DC USN (Ret)	27 August 1958
CDR Frederick G. Abeken MC USN (Ret)	23 September 1958
LCDR Ralph P. Morse DC USN (Ret)	12 August 1958
LT Arthur W. Picard MSC USN (Ret)	24 August 1958
CWO Walter E. Quenstedt HC USN (Ret)	10 September 1958
CWO Roy E. Wahl MSC USN (Ret)	12 September 1958

* * * * * *

From the Note Book

1. CAPT W. C. Calkins MSC USN, first Chief of the Navy Medical Service Corps, was placed on the list of retired officers on 1 October 1958 after four years in office and more than thirty-nine years of active naval service. (TIO, BuMed)

2. CAPT L. J. Elsasser MSC USN has been appointed Chief of the Navy Medical Service Corps. He succeeds CAPT W. C. Calkins. (TIO, BuMed)

3. CAPT R. R. Rambo MC USN, who for several years has been the Medical Director of the Navy Mutual Aid Association, was recently appointed a Vice President of the Association. CAPT Rambo's new duties will be in addition to those of Medical Director. (TIO, BuMed)

4. Early detection of staphylococcal infections in hospitals, rigid measures to prevent their spread, and increased research to find better methods of preventing and treating them have been recommended by the National Conference on Staphylococcal Disease. The Conference, cosponsored by the Public Health Service and the National Research Council, was attended by delegates from 59 professional organizations and numerous authorities on various aspects of the infection problem. (PHS, HEW)

5. A rapid, accurate colorimetric method for detecting and measuring minute quantities of acetylene in air (as low as 10 parts per billion) has been developed by the National Bureau of Standards in cooperation with the U. S. Public Health Service. (NBS)

6. This article discusses the practice of toxicology and defines clinical toxicology as that branch of medicine concerned with prevention, diagnosis, and treatment of conditions produced by poisons. (Postgrad. Med., Sept. 1958; W. J. R. Camp)

7. This report is a study of 52 cases of malignant pleural effusion by the Vim-Silverman needle biopsy technique. Of these cases, 50 were also studied for malignant cells by the Papanicolaou technique. (Cancer, Sept. - Oct. 1958; M. L. Samuels, M. D., J. W. Old, M. D., C. D. Howe, M. D.)

8. A relatively simple technique for obtaining urine cultures from female patients based on the use of sterile voided urine collections and a quantitative culture technique is described and evaluated by comparison with catherized urine collections. (J. Lab. & Clin. Med., September 1958; A. D. Merritt, M. D., J. P. Sanford, M. D.)

9. Twenty-seven full thickness burns of the dorsum of the hand have been treated by early excision and grafting. Of the 21 hands in the surviving patients, 12 regained a completely full range of motion. In the remainder, the return of function was adequate for all but finely coordinated activity. Split thickness grafting resulted in elastic skin coverage with no need for revision of covering of the dorsum of the hand. (Am. J. Surg., October 1958, J. A. Moncrief, M. D.)

10. The effect of albumin and globulin fractions (isolated by the electrophoretic technique from the serum of apparently healthy individuals and from patients with infectious hepatitis, post-hepatic jaundice, hepatic cirrhosis, rheumatoid arthritis, lupus erythematosus and subacute bacterial endocarditis) upon the cephalin-cholesterol, colloidal red, colloidal gold, colloidal blue, thymol and distilled water tests, have been studied for the purpose of elucidating the mechanisms of these tests. (Gastroenterology, September 1958; R. Armas-Cruz, M. D. et al.)

11. A review of 30 cases of periodic neutropenia collected from the literature is presented to emphasize that this disease is no longer extremely rare. The indication for splenectomy is outlined and the cases having had splenectomy are reviewed to substantiate that this indication is correct. (Arch. Int. Med., September 1958; G. W. Duane, M. D.)

12. The place of local anesthesia in surgery is discussed from the standpoint of the operator and that of the patient. Methods of application, anesthetic agents, dosage, and potential hazards are described. (Arch. Surg., September 1958, D. M. Glover, M. D.)

13. Two cases are reported of a fatal syndrome of refractory watery diarrhea, hypokalemia, and vacuolar nephropathy in association with non-insulin-secreting islet cell adenomas of the pancreas. (Am. J. Med., September 1958; J. V. Verner, M. D., A. B. Morrison, M. D.)

14. The management of perforated peptic ulcer is discussed. (Surgery, September 1958; C. J. Berne, M. D. W. P. Mikkelsen, M. D.)

15. An editorial by Dr. Helen B. Taussig in September 1958 Circulation discusses the selection of patients for surgical repair in congenital defects of the heart.

* * * * * *

Recent Research Reports

Naval Dental Research Facility, NTC, Bainbridge, Md.

1. Survey of Dental Health. III. Tooth Brushing Habits. NM 75 01 26.04, 2 June 1958.
2. Characteristics of Saliva of Dental Caries Free and Dental Caries Rampant in Young Male Adults. NM 75 01 26.02.02 and NM 75 01 26.03.01, 15 July 1958.

3. Microscopic Study of Saliva Sediment. II. The Cellular Elements of Saliva and Their Relation to Dental Caries Experience and Gingivitis. NM 75 01 26.06, 15 August 1958.

Naval Medical Research Institute, NNMC, Bethesda, Md.

1. Typical Behavior of Some Simple Models of Enzyme Action. NM 01 01 00 .02.03, 9 January 1958.
2. Hemolytic Effect of Ionizing Radiations and Its Relationship to the Hemorrhagic Phase of Radiation Injury. NM 62 02 00.01.03, 21 March 1958.
3. IFR Flight without Attitude Instruments. NM 15 01 00.01.01, 25 April '58.
4. Further Studies on Host-Cell Preferences by Exoerythrocytic Stages of Avian Malaria. NM 52 01 00.02.02, 2 May 1958.
5. Some Measurements of the Brightness of a Sea Water Surface under Clear Weather Conditions. NM 18 01 00.02.02, 15 May 1958.
6. Nerve Blockade Produced by Holothurin, a Glycosidic Mixture Derived from the Sea-Cucumber. NM 02 02 00.01, 28 May 1958.
7. Cell-Bound Antibodies in Transplantation Immunity. NM 71 01 00.03.01, 10 June 1958.
8. Convulsant Activities of Aminocyclanol Derivatives as Influenced by Stereochemical Configurations. NM 02 02 00.01.07, 10 June 1958.
9. Polynucleotides VI. The Influence of Various Factors upon the Structural Transition of Polyriboadenylic Acid at Acid pH's. NM 02 01 00.01.05, 26 June 1958.
10. Summaries of Research. 1 January - 30 June 1958, 30 June 1958.
11. Quantitative Participation of Fatty Acid and Glucose Substrates in the Oxidative Metabolism of Excised Rat Diaphragm. NM 72 02 00.02.01, 11 July 1958.
12. Demonstration of the Marrow-Vascular Space (Macrocanalicular System) of Bone. NM 71 01 00.06.02, 11 July 1958.

Naval Medical Research Unit No. 3, Cairo, Egypt

1. Hunterellus Theileri Fiedler (Encyrtidaf, Chalcidoidea) Parasitizing an African Hyalomma Tick on a Migrant Bird in Egypt. NM 52 08 03.3.05, February 1958.
2. Cardiopulmonary Studies in Schistosomiasis. Pulmonary Function Tests, Hemodynamic and Pharmacodynamic Studies in Bilharzial Cor Pulmonale. NM 72 01 03.4 .04, March 1958.
3. Carcinoma of the Urinary Bladder Associated with Urinary Schistosomiasis Malignant Bladder Tumors in Egypt - A Pathological Study of 73 Cases. NM 52 02 03.6, May 1958.
4. Review of the Snake Genus Spalerosophis. NM 52 08 03.7.04, June 1958.

Naval Medical Research Unit No. 4, Great Lakes, Ill.

1. Isolation of Coxsackie Group B Viruses from Cases of Respiratory Illness, Great Lakes, 1957. NM 52 05 04.4.2, 23 July 1958.

Naval Air Development Center, Johnsville, Pa.

1. Study of Human Performance Limitations in Aircraft Catapulting with a Linear Track; letter report on proposed experimental program. NM 11 02 12.2, 13 August 1958.
2. Aviation Textiles and Textile Treatments, Thermal Protection Capacity; (Letter report concerning experimental comparison of fire-retardant flight suit sample and THPC-APO treated cotton-fortisan fabric and fabrics of known optical and thermal properties.) TED ADC AE-5109, 18 August 1958.

Naval School of Aviation Medicine, NAS, Pensacola, Fla.

1. Study of Preferences for Type of Naval Air Advanced Training. Report No. 1, Subtask No. 8, NM 16 01 11, 6 January 1958.
2. Investigation of the Magnitudes of Galvanic Skin Resistance Responses that Occur with Different Intensity Levels of Shock, Conditioned Tone, and Extinction Tone. Report No. 75, Subtask 1, NM 18 02 99, 15 February 1958.
3. Studies on the G-Tolerance of Invertebrates and Small Vertebrates while Immersed. Report No. 2, Subtask No. 1, NM 19 01 11, 1 March 1958.
4. Effect of the Valsalva Maneuver on Circulation Time. Report No. 13, Subtask No. 5, NM 18 03 11, 1 April 1958.
5. Evaluation of Certain Visual and Related Tests II. Phoria. Report No. 2, Subtask No. 6, NM 14 01 11, 17 April 1958.
6. Accident Data, Instructor Comments, and Student Questionnaire Responses as Indicators of Transition Training Problem Areas. Report No. 1, Subtask No. 7, NM 14 01 11, 25 April 1958.
7. Relationship between Cardiovascular Response and Positive G Tolerance. Report No. 11, Subtask No. 1, NM 11 01 11, 8 May 1958.
8. New and Objective Method for Measuring Ocular Torsion. Report No. 46, Subtask No. 1, NM 17 01 11, 15 May 1958.
9. Effects of Rate and Direction of Conditioned Stimulus Change on Avoidance Performance. Report No. 4, Subtask No. 12, NM 14 02 11, 15 May 1958.
10. Ionization Dosage from X- and Beta Rays in Flight through Auroral Displays. Report No. 15, Subtask No. 1, NM 12 01 11, 2 June 1958.

Office of Naval Research, Washington, D. C.

1. Survey of the Dental Health of the Naval Recruit. Report 58-5, January '58. (prepared by Psychological Research Associates, Inc., Arlington, Va.)

DENTAL SECTION

Experiences and Problems with Subperiosteal Implants

The problems of mandibular and maxillary subperiosteal implants, as experienced by Hugo L. Obwegeser of Zurich, Switzerland, were reported at the Sixty-Fourth Annual Meeting of the American Dental Society of Europe which was held recently in Knokke, Belgium. Thirty-five implants of electrically polished vitallium were inserted in 32 patients. No wire or screws were necessary to hold the implant in place; however, the report stated that subperiosteal wire may be used for a short period to insure stability and then removed. Three weeks after insertion, the implants were usually firmly imbedded and construction of dentures was started. Antibiotics were not routinely administered following the surgical procedure. It was found that delay in insertion more than 2 weeks after the impressions were made increased the possibility of bone absorption and improper fitting of the implant.

Some of the complications experienced were: suture infection, hematoma, calculus on the abutments, bone absorption under the implant (the tissue following the bone leaving the implant partially exposed), fistulas forming around the abutments, and breakage of abutments. The bone absorbed so much in some cases that the implant settled enough to put pressure on the mental nerves resulting in parasthesia or anesthesia.

At the time of the report, some of the implants had been in place up to 3 years. Within the first year after insertion, 30% of the patients had complications. In instances where the implants had been in place from 1 to 3 years, 19 patients had tissue inflammation. In another 13 patients, there was no inflammation, but 2 had parasthesia, 1 had anesthesia, 1 complained of pain during weather changes, and only 9 were free from complications.

Because two-thirds of the patients experienced complications, the author was of the opinion that subperiosteal implants are "an unbiological procedure," and that one could not promise long term satisfactory results. He concluded that more research will be required to determine the factors responsible for the complications.

* * * * * *

New Dental Corps Exhibit at ADA Meeting in Dallas

A new U. S. Navy Dental Corps exhibit, Dentistry in the Modern Age, will be shown for the first time at the Annual Session of the American Dental Association in Dallas, Texas, November 10 - 13, 1958.

The exhibit is 24 feet in length with a back drop depicting the universe as representative of the modern space age. The informative material of the exhibit includes the use of television as a training aid; the use of radio-isotopes in dental research; and U. S. Navy Dental Corps support in the Antarctica. This material is presented by means of three movable consoles, each of which may be placed in the foreground at the exhibit for demonstration. The consoles are designed for independent use in the training program at the U. S. Naval Dental School when the exhibit is not scheduled for showing at professional meetings.

Captain V. J. Niiranen DC USN and Captain J. P. Arthur DC USN will monitor the exhibit at the Dallas meeting.

* * * * * *

RESERVE SECTION

Correspondence Course Training

COMBAT AND FIELD MEDICINE PRACTICE - NavPers 10706-A. 1957 edition, recommended for all Medical Department personnel.

Medical practice in combat, whether afloat or ashore, raises many complex problems which tax to the utmost the abilities of departmental personnel. The whole effort of the Medical Department achieves its ultimate purpose in medical practice during combat. The purpose of this course is to enable personnel to perform their combat functions with maximum effectiveness, to accomplish assigned mission, and to "survive." This course provides a set of principles and flexible formulae which can be applied to varying combat conditions. The discussions presented relate to the management of battle casualties, care of neuropsychiatric casualties in combat areas, traumatic shock, medical aspects of tropical warfare, and the medical aspects of warfare in extremely cold climates. Prevention and control of disease are predicated on the latest opinions and research and on the combined experiences of the Armed Forces.

The course consists of four (4) objective type assignments and is evaluated at sixteen (16) Naval Reserve promotion and/or nondisability retirement points. Naval Reserve personnel who previously completed the correspondence course, Combat and Field Medicine Practice, NavPers 10706, will receive additional credit for the completion of course NavPers 10706-A.

SUBMARINE MEDICINE PRACTICE - NavPers 10707-A. (Revised 1958) (Available on or about 1 November 1958) Recommended for all Medical Department personnel.

This course presents the highlights of latest developments and the accumulated knowledge and experience resulting from years of research and investigations. It is designed as a comprehensive guide which can be utilized for training Medical Department personnel in the many intricate problems connected with submarine medicine practice. Recent atomic ventures and developments in underwater military operations demand a greater surveillance of the medical problems involved.

Discussions concentrate on personnel selection and assessment procedures, improvement of submarine habitability factors, solution of human engineering problems aboard submarines, submarine escape and rescue operations, and the medical aspects of all other under sea operational problems directed toward the improvement of the military effectiveness of the Submarine and Amphibious Forces. For the medical officer interested in the solution of these many unsolved problems, Submarine (underwater) Medicine practice offers a most challenging field. Increased cruising range and prolonged submergence of modern submarines, penetration of greater depths by the deep sea diver, and the expanding practice of underwater swimming demand continued effort in research.

The course consists of six (6) objective type assignments and is evalutated at eighteen (18) Naval Reserve promotion and/or nondisability retirement points. Naval Reserve personnel who previously completed course NavPers 10707, will receive additional credit for the completion of course NavPers 10707-A.

TROPICAL MEDICINE IN THE FIELD - NavPers 10995. (Revised 1958) (Available on or about 1 November 1958). Recommended for all Medical Corps officers.

During World War II, tropical diseases caused more casualties in many areas than did enemy action. Such diseases have long been a serious deterrent to successful military operations in the tropics. The added experience of recent wars has naturally heightened military interest in tropical medicine, especially in the application of the many recent advances in medicine to the treatment of tropical diseases.

The purpose of this course is to provide a concise guide in tropical medicine not only for the physician practicing in the tropics, but also for the physician in temperate zones who may be encountering tropical diseases of servicemen and others returning to the United States after a tour of duty in the tropics. The course is based upon a Manual of Tropical Medicine by Mackie, Hunter, and Worth; it covers the essential practical aspects of epidemiology, diagnosis, treatment, and prophylaxis of the more important tropical diseases.

Laboratory analysis plays an especially helpful and dramatic role in the diagnosis of diseases in indigenous personnel in tropical areas where the language barrier may make a provisional diagnosis difficult. Another factor to be considered is that natives of tropical areas may react to local diseases with symptoms very unlike those exhibited by non-natives. The text stresses the importance of military medicine and special effort has been directed to the condensation of information essential for the Armed Forces, the clinician, field worker, and the student of tropical medicine.

The course consists of twelve (12) objective type assignments and is evaluated at thirty-six (36) Naval Reserve promotion and/or nondisability retirement points. Naval Reserve personnel who previously completed the correspondence course, Tropical Medicine in the Field, NavPers (none), edition 1950, will receive additional credit for the completion of course NavPers 10995.

Application Instructions

1. The form, Application for Enrollment in Officer Correspondence Course, NavPers 992 (Rev 1/57) or later revision, should be appropriately filled out and forwarded to the Commanding Officer, U. S. Naval Medical School, National Naval Medical Center, Bethesda 14, Md. Make the appropriate change in the "To" line in Box J of the application form. These forms can be obtained from your Commanding Officer or from the respective District Headquarters.

2. Completed applications will be forwarded as follows:

   a. If on active duty: via your Commanding Officer

   b. If on inactive duty and not in a training program under the cognizance of the Chief of Naval Air Reserve Training (CNART): via your Naval District Commandant.

   c. If on inactive duty and in a training program under the cognizance of CNART: via the Commanding Officer of NAS or NARTU having responsibility for the training program.

   d. If on inactive duty and residing in a foreign country: via (1) the local Naval Attache or Force Commander, if any, and (2) the command maintaining your service record (usually your home District Commandant).

3. Caution! Do not send applications for enrollment in Medical Department correspondence courses to the U. S. Naval Correspondence Course Center, Naval Supply Depot, Scotia 2, New York. Such procedure delays the processing of the application for several weeks. Send to that address only applications for enrollment in courses administered by that center.

Multiple Enrollment. Medical personnel may be enrolled in more than one Medical Department correspondence course at one time.

* * * * * *

AVIATION MEDICINE DIVISION

Naval Aviator - Flight Surgeon

For a number of years, the Chief of Naval Operations has permitted the Chief of the Bureau of Medicine and Surgery to nominate a limited number of qualified flight surgeons for training as naval aviators. Those flight surgeons who successfully complete the training syllabus are designated naval aviators and are ordered to duty as such in the actual control of aircraft. This is in addition to duties for which they are assigned as medical officers.

In the near future, there will exist vacancies for several naval aviator-flight surgeons and it is desired that deserving, well motivated, 35 years of age or younger, and physically qualified Regular U. S. Navy flight surgeons fill these vacancies. Successful candidates shall be assigned to test pilot billets connected with the human engineering phases of the Navy's developmental programs, as well as other related operational and administrative assignments.

Those active duty flight surgeons, U. S. Navy or U. S. Navy Reserve, who are particularly desirous of becoming naval aviators are invited to apply for flight training by letter request to the Chief, Bureau of Medicine and Surgery, Aviation Medicine Operations Division, Navy Department, Washington 25, D. C. Flight surgeons who complete the training and are designated as naval aviators shall incur a service obligation of 3-1/2 years following date of designation. Applicants should include this service agreement in their applications.

The Pros and Cons of Stimulating Drugs

I. Introduction

There is no class of drugs that is used more often by flying personnel than the stimulating drugs. For a few cents, one can obtain, without prescription, a therapeutic dose of caffeine and other xanthine derivatives, simply by buying a cup of coffee, a cup of tea, or a bottle of cola beverage. Caffeine is the only drug routinely available in-flight for crew members and passengers alike in the larger Air Force aircraft.

II. CAFFEINE

1. Pharmacology. What is this drug that is so readily available and so plentifully consumed? It is, to quote Goodman and Gillman, "A powerful central nervous system stimulant affecting mainly the cortex, the medulla, and spinal cord, in that order." Caffeine is the xanthine of clinical choice for combatting central nervous system depressions. It produces a more rapid and clearer flow of thought, allays drowsiness and fatigue, and under the influence of this drug, one is capable of a more sustained intellectual effort and a more perfect association of ideas. There is a keener appreciation of sensory stimuli, and motor activity is likewise increased. Reaction time to stimuli usually decreases upon using caffeine, but there may be an adverse effect upon recently acquired motor skills in tasks involving delicate muscular coordination and accurate timing, such as the firing of small arms. All of these effects occur with a dosage of 150 to 250 mgm. which is a cup or two of coffee or tea. Even at these dosage levels, there is an appreciable blood caffeine level 6 to 12 hours after ingestion. Now the usual individual denies that he has experienced stimulation from ingesting a caffeine-containing beverage. The reason for this is that the drug action is so physiologic that one is usually completely unaware of it. There is considerable controversy as to whether or not a mild physiological stimulation produced by small amounts of caffeine is followed by any "let-down."

More to the point, a laboratory test which simulates automobile driving has shown that 90 minutes after the administration of caffeine orally, a test subject has a very distinct change in his method of driving with hasty nervous and restless accelerator pedal operation. There were more errors due mainly to hasty reactions. This effect persisted for at least 6 hours. So it can be seen that caffeine is not as harmless a drug as is customarily thought.

2. Experience. In spite of all of this evidence, these effects are compared with the Air Force experience of what happens when caffeine is used. No report could be found in which an aircraft accident or incident was attributed as such to the use of caffeine in any quantity. Apparently, those who use caffeine have had enough experience to be aware of their

own tolerances. Certainly, the toxic effects are severe enough to warrant occasional warnings and advice to aircrew members.

III. DEXEDRINE

1. Pharmacology. A second type of stimulant is the sympathomimetic drug group, especially d-amphetamine, or Dexedrine. The results of many studies on the effects of this drug upon fatigue are contradictory, mainly because of the lack of a common definition of fatigue, how to produce it, and how to measure changes in it. In general, it seems that the diminished sense of fatigue is subjective and central in origin. Payne and his group at the School of Aviation Medicine have shown that Dexedrine prevents the onset of fatigue for at least 4 hours in persons performing a complex perceptual-motor task, as measured by scores attained and symptoms. This effect was not decreased by oxygen impoverishment nor increased by oxygen enrichment, hence the sustentative effect of Dexedrine is almost wholly derived from its effect upon alertness.

Dexedrine has one-and-a-half to two times the central stimulation potency of the racemic amphetamine sulfate, or Benzedrine, and the pressor effects are about equal milligram for milligram. For this reason, when advantage is taken of this differential in pharmacological effectiveness, there has been much less difficulty with the pressor effects typical of the racemic compound, such as various cardiac arrhythmias, headache, light-headedness, vasometer disturbances, agitation, confusion, dysphoria, apprehension, delirium, depression, and fatigue. One of the great worries in the use of Dexedrine, however, is still that all of these reactions can occur because there is a very wide individual difference in reaction to all drugs of this type. Furthermore, one of the more useful effects of central stimulation by Dexedrine has been the clinical induction of moderate to severe anorexia in obese patients; nutritional status of flying personnel is always of concern and the introduction of a potent anorexia drug is not desirable as such. On the basis of these considerations, the routine use of any sympathomimetic drug by any group of persons is to be condemned. Most of the other sympathomimetic drugs, such as Benzedrine and Wyamine, possess too potent a cardiovascular action to be useful in-flight.

2. Experience. More experience in the actual use of Dexedrine in flying personnel through two main sources is steadily being gained. The first source is the group of obese individuals who are striving to meet the body weight requirements; many of these persons are taking Dexedrine either surreptitiously or with the consent of their flight surgeons. The important thing is that the Dexedrine taken for this purpose, thus far, is not causing death and injury—at least as far as is known. A second source of clinical material has been the use of this drug in maximum effort missions where it has been felt that the hazards of mission-induced fatigue outweighed

those of the drug. There have been published no reports of accidents or incidents in-flight directly attributable to the use of Dexedrine within the Strategic Air Command. The Aero Medical Safety Division of the Directorate of Flight Safety Research has no record of any accidents attributed to stimulating drugs. In fact, that office has a number of accidents wherein fatigue was a contributing cause and the use of such a stimulant might have prevented the accident.

Recently, the Tactical Air Command has become involved with the problem of long-range fighter operations facilitated by mid-air refuelings. The program instituted for such flights has been carefully planned so that the pilots receive adequate nourishment and rest the night before flight, Dexedrine about 2 to 3 hours after take-off, and at least 48 hours of rest, mental relaxation and mild physical exercise after completion of the flight. The Dexedrine is given in a 15 mgm. sustained-release capsule, so that in-flight "let-down" or depression is avoided. Two hours before landing, this is augmented by 5 mgm. more of the Dexedrine, this time in tablet form. All individuals using these drugs have been tested for idiosyncracy on the ground before in-flight use is prescribed. There have been no untoward reactions to this drug when used in this fashion. The pilots, in fact, have been so favorably impressed with this drug that they now insist upon its use for this particular type of mission. Some have been found to be over-stimulated post-flight and were given one-and-a-half ounces of spiritus frumenti and a few required 100 mgm. of Seconal at bedtime. The use of any drug, such as alcohol and the barbiturates, while the subject is still under the influence of Dexedrine, is open to question due to the insidious changes in judgment and perverse emotional responses which may arise with such attempts at sedation.

A different system of medication is used by the Strategic Air Command due to differences in mission requirements. In shorter flights (that is, up to 17 hours' duration) a 5 mgm. tablet of Dexedrine is given about 4 hours before landing. In flights of longer duration when no rest period is available for the crew members, multiple dosage on the same flight is required. These doses are spaced so as to avoid the rebound depression; for example, there may be a 6-hour interval between the first and second tablets and a 4-hour interval between the second and third. Again, the flyers are cautioned about taking any kind of medication and all are pretested for tolerance to the drug.

Therefore, on the basis of Air Force experience with the drug Dexedrine, no reason to condemn its judicious use is found. To the contrary, Dexedrine seems to be specifically indicated for specific purposes, such as the maximum effort, long duration flight, where fatigue must be avoided during frequent and repeated critical intervals of time, such as air refueling. It is certain that the use of Dexedrine must be only for specific occasions and under the direct supervision and control of the flight surgeon. Whenever

the drug is used, an adequate period of recuperation must be programmed and followed. It would seem wise to assure by proper observation the night before flight that Dexedrine is not going to be used to overcome the effects of other drugs, especially ethyl alcohol, nicotine, long-acting sedatives, and antihistamines. Experience has shown that the use of drugs as a substitute for sleep and sobriety has been followed by repeated aircraft accidents which must be attributed to the unnatural fatigue and intoxication, not to the stimulants. It is, therefore, maintained that a highly active aircrew effectiveness program in well trained aircrews is the first procedure to be followed; only after this is in existence can one determine the need for stimulating drugs.

When the capabilities of a well trained and physically fit individual have been exceeded by the mission requirements, the ultimate solution lies not in drugging the pilot, but rather in revising the machine systems, such as in-flight refueling systems, navigation systems, and control systems so that human capabilities are not exceeded while the mission is still accomplished.

IV. Discussion

All stimulating drugs have the disadvantages of post-stimulation, depression, the impairment of needed sleep, other signs of over-stimulation, the danger of exhausting physical reserves that otherwise would not have been tapped, and finally, habituation and even addiction to the drugs. Side effects, such as anorexia, sympathetic nervous system idiosyncrasy, and individual variation in toxic thresholds require special attention. It must be conceded that there is not a drug in existence which can bring the human organism to that level which it reaches by normal training, proper nutrition, and adequate sleep. On the other hand, it is recognized that there are missions which require even more than these basic mechanisms will achieve and that as a result stimulating drugs are being used every day in flight. It is, therefore, necessary to place a reasonable control over the use of these drugs. In the case of the xanthine derivatives, this can be done by adequate indoctrination of flying personnel. Absolute control over the use of the sympathomimetic drugs must be maintained. This latter group, particularly Dexedrine, can be used to advantage in flying personnel for a few highly specific purposes, especially in the Strategic Air Command and the Tactical Air Command, but careful medical judgment must be mandatory before administering such potent drugs. At the present time, it appears that stimulating drugs are indicated whenever the risks of in-flight fatigue surpass the rather limited risks of the drugs themselves. Adequate pre- and post-flight management of persons using these drugs is necessary in the interest of flying safety and human conservation. The fact that the drug is required should automatically indicate the urgent need for further research and development of the aircraft systems. Drugs are to be used only as stopgap aids and not as a permanent solution to a specific problem.

V. Conclusions

1. The present usages of caffeine are safe.

2. A complete aircrew effectiveness program is basic and Dexedrine is only for essential augmentation of human capabilities.

3. Dexedrine should be given only when required by the mission with adequate pre-, in-, and post-flight aeromedical supervision and control.

4. The need for a sympathomimetic stimulant indicates the inadequacy of the weapons system for the mission.

VI. Recommendations

1. The use of Dexedrine in-flight should be permitted, but only under complete aeromedical supervision.

2. An unsatisfactory report upon the weapons system should be mandatory before Dexedrine can be used in-flight in that type of aircraft on that type of mission. This report should be made by the flight surgeon and should contain comments as to what mechanical systems are contributing heavily to the fatigue, and suggestions as to improvements. (Captain E. R. Taylor (MC) USAF, Toxic Hazards in Military Flying and in the Aviation Industry: Symposium, Wright-Patterson AFB, 6-7 November 1958)

* * * * * *

Partial Pressure Suit Protection

At the present time, many erroneous conceptions exist in regard to the protection afforded by the partial pressure suit. An attempt is made here to clarify the capability of the suit and to explain why the over-all protection is somewhat limited.

First of all, some basic facts should be reviewed. The partial pressure suit was primarily designed to protect the aircrew member against his greatest natural enemy—hypoxia. With the development of aircraft which can operate above 43,000 feet, hypoxia has developed into a full-grown raging monster. The suit, however, has proved itself in this respect and men have been afforded protection against hypoxia under circumstances in which the total barometric pressure was measured in fractions of a millimeter of mercury—for all practical purposes, a vacuum.

Probably the greatest misconception evident at the present time is in regard to the protection which the suit offers against the "bends," the most common type of evolved gas decompression sickness. This misconception has probably arisen from the fact that it is common knowledge that when the suit is inflated a system of pneumatic levers draws the skin-tight suit even tighter, thereby putting a tremendous amount of external mechanical pressure upon the surface of the body. Many people have assumed that this external mechanical pressure is in effect creating an artificial atmosphere on the user's body. They also assume that the

amount of pressure applied to the surface of the body will have the effect of "taking the body down to a lower altitude"—10,000 feet for instance, thereby eliminating the possibility of developing the "bends." This is not the actual true case!

The external mechanical pressure which is applied to the surface of the body is necessary to assist in fighting the basic enemy—hypoxia! The principle is actually somewhat simple. At extreme altitude, 45,000 feet and above, 100% oxygen under very high pressure must be forced into the lungs to prevent hypoxia. The amount of pressure is great enough to physically damage the lungs, slow down the blood flowing in the lungs, decrease the ability of the heart to pump blood, and create other disturbances of body function. To offset the above disturbances, pressure must be applied to the outside of the body to equalize the high internal pressure. The skin-tight suit and pneumatic lever system provide this necessary "balancing counter-pressure." Thus, the individual is able to breathe oxygen under high pressure and prevent hypoxia without the bodily disturbances mentioned previously.

It is true, however, that some degree of "bends" prevention is provided by the external suit pressure, but not to the extent that some individuals have assumed. The actual facts are:

The external pressure of the suit gives the same degree of "bends protection" at extreme altitude—say 100,000 feet—that an individual would normally have when flying at 40,000 feet without a suit. Also, it is not possible to give the body any greater degree of "bends protection" than that which would normally exist between 30,000 and 40,000 feet without a suit. In other words, with the suit operating at its maximum pressure, it is not possible to lower the body physiologically much lower than 30,000 feet. This altitude is the threshold for the "bends"—which may or may not develop—depending upon many variable factors.

To clarify the above, the following examples are offered: (Note: The breathing pressures given and suit pressures have been scientifically determined and are standard.)

To prevent hypoxia at 100,000 feet, a breathing pressure of 140 mm. of mercury is necessary. An equal amount of pressure must be applied to the external surface of the body and this is accomplished by the pneumatic levers (capstans). The individual is now fully protected against hypoxia, but what about the degree of "bends protection"? This is easily determined as follows:

Barometric pressure at 100,000 feet,	=	0.31 mm/hg
External suit pressure at 100,000 feet	=	140.00 mm/hg
Total external pressure at 100,000 feet	=	140.31 mm/hg

The physiological altitude of the body is now that one where the atmospheric pressure is 140.3 mm/hg and in this case is 40,000 feet. (140.7 mm/hg at 40M is actual figure.) In other words, with the suit fully inflated and at maximum pressure at 100,000 feet, the crew member has

the possibility of developing the "bends" as though he were at 40,000 feet without a suit. In an actual case, however, the extremely high rate of "ascent" following a decompression in flight would have a tendency to speed up the onset of "bends."

Now, apply the above procedure to a lower altitude for comparison. At a flight altitude of 48,000 feet, the suit would be needed; to compare the "bends protection" possible that figure is used:

Barometric pressure at 48,000 feet	=	96.0 mm/hg
External suit pressure at maximum setting	=	140.0 mm/hg
Total external pressure	=	236.0 mm/hg
Equivalent physiological altitude	=	29,000 feet

It is now evident from the above that, regardless of altitude or suit pressure, in regard to the "bends," the suit can only provide protection equal to the normal reaction between 29,000 and 40,000 feet without the suit. In this example, a maximum suit pressure was used to illustrate that the body will still be in the "bends zone" regardless. The actual breathing and suit pressure required at 48,000 feet would give the following relationship:

Barometric pressure at 48,000 feet	=	96.0 mm/hg
External suit pressure at 48,000 feet	=	55.0 mm/hg
Total external pressure	=	151.0 mm/hg
Equivalent physiological altitude	=	38,500

In conclusion, the following points deserve further evaluation from a combat operational standpoint. It is most likely that the aircraft used will have a pressurization system which will keep the cockpit altitude at 30,000 feet or below which conventional systems are now doing. In turn, the suit will probably not be worn in the inflated or emergency state. Should a decompression occur, two important questions arise:

1. Will the pilot be required and expected to complete the mission? If so, hypoxia will not be a problem, but the "bends" must be given consideration. They may or may not develop. If they do arise, there is no way to predetermine the severity. They may be mild or barely perceptible or they may be severe and possibly incapacitating. More than likely, they will develop to a noticeable degree.

2. Is a prolonged denitrogenation period necessary prior to a routine or combat mission? Prolonged denitrogenation prior to flight has proved to be very effective in the prevention of "bends" during altitude chamber runs using the suit. However, even with a long period of denitrogenation, it is possible to develop a degree of "bends," but not to the extent had no denitrogenation been employed. Should a combat operational study of the above be made and denitrogenation adopted as the answer, the "way of life" on the flight line will be changed remarkably,

but isn't it natural to assume such a change when the tremendous change occurring in operational aircraft and altitudes is considered?

(CAPT T. W. Worley USAF (MSC), Air Force Physiological Training Program News Letter, No. 25, September 1956)

* * * * * *

Policy

The U. S. Navy Medical News Letter is basically an official Medical Department publication inviting the attention of officers of the Medical Department of the Regular Navy and Naval Reserve to timely up-to-date items of official and professional interest relative to medicine, dentistry, and allied sciences. The amount of information used is only that necessary to inform adequately officers of the Medical Department of the existence and source of such information. The items used are neither intended to be, nor are they, susceptible to use by any officer as a substitute for any item or article in its original form. All readers of the News Letter are urged to obtain the original of those items of particular interest to the individual.

* * * * * *

DEPARTMENT OF THE NAVY
U. S. NAVAL MEDICAL SCHOOL
NATIONAL NAVAL MEDICAL CENTER
BETHESDA 14, MARYLAND
OFFICIAL BUSINESS
Permit No. 1048

POSTAGE AND FEES PAID
NAVY DEPARTMENT